Mathematics 172

Quiz #18 Name: Key

You must show your work to get full credit.

Consider a species of beetle that lives on small islands in the amazon river. We assume that an island unpopulated by the beetle has a probability of

$$p_i = .2$$

of being colonized by the beetles in a given year and that a populated island has a probability of

$$p_e = .8$$

of having its beetle population go extinct in a year.

Let f be the fraction (or proportion) of the islands that are populated at a given time. We ~~say~~ said today in class that it is reasonable to assume that f satisfies the rate equation

$$\frac{df}{dt} = p_i(1-f) - p_e f$$

1. Using the values of p_i and p_e above write the rate equation.

$\frac{df}{dt} = .2(1-f) - .8f$

2. Find the equilibrium points of the rate equation:

Equilibrium points are: .2

solve

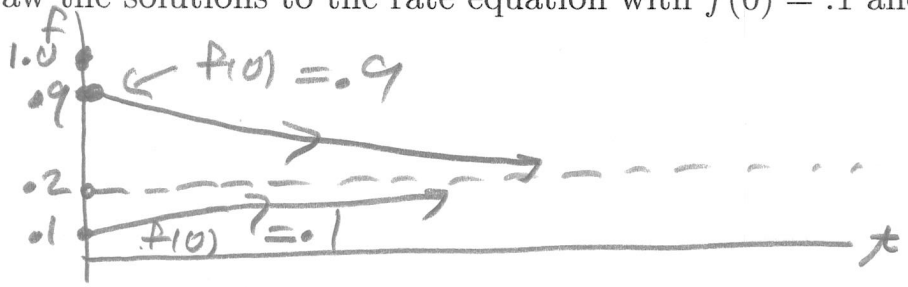
$\frac{df}{dt} = .2(1-f) - .8f = 0$

$.2 - .2 - .8f = 0$

$-f = -.2$

$f = .2$

3. Draw the solutions to the rate equation with $f(0) = .1$ and $f(0) = .9$.



4. Estimate the following:

All solutions tend to .2 for large t.

$f(20) \approx$ .2

$f(30) \approx$ .2

$f(132) \approx$ .2